VOLUME XIV NUMBER 9 WHOLE NUMBER 107

THE JOURNAL

OF

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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THE JOURNAL

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ROYAL ASTRONOMICAL SOCIETY

OF CANADA

VOL. XIV, No. 9 NOVEMBER, 1920. WHOLE No. 107

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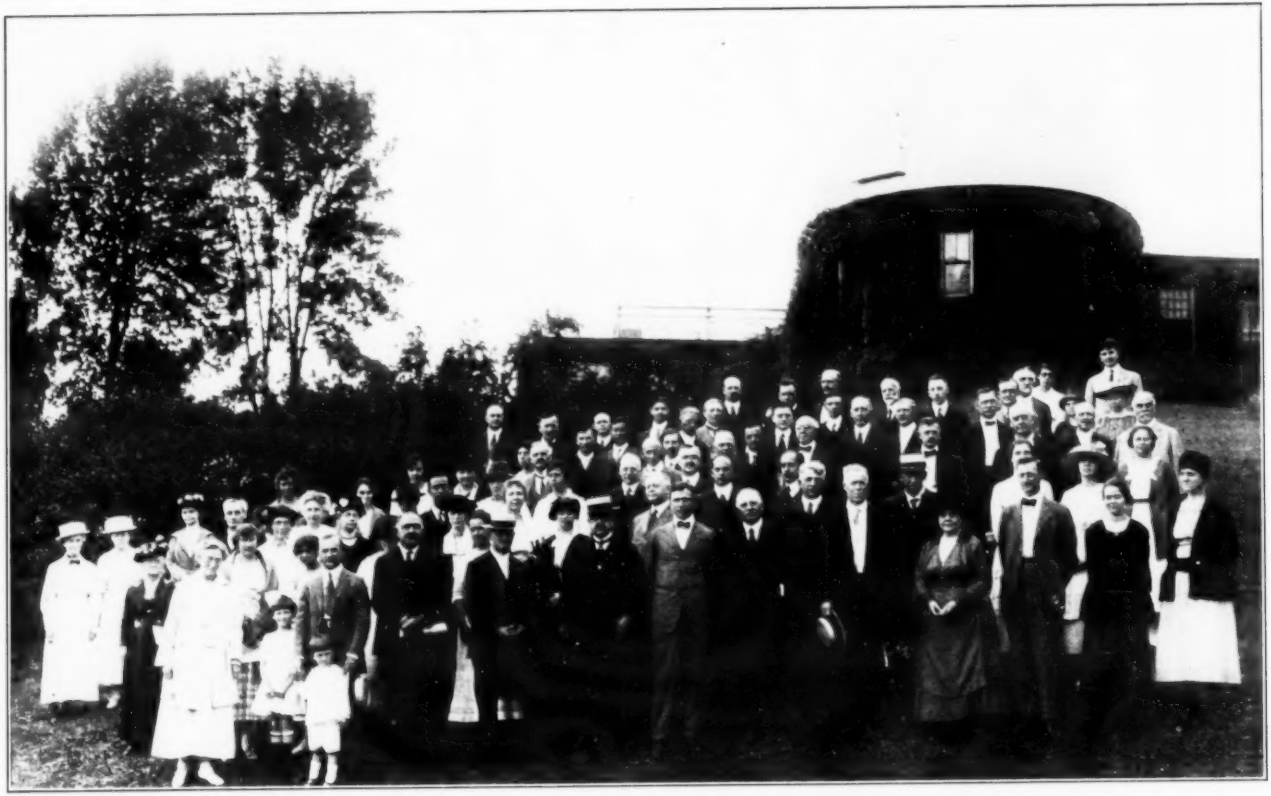
PLATE IX

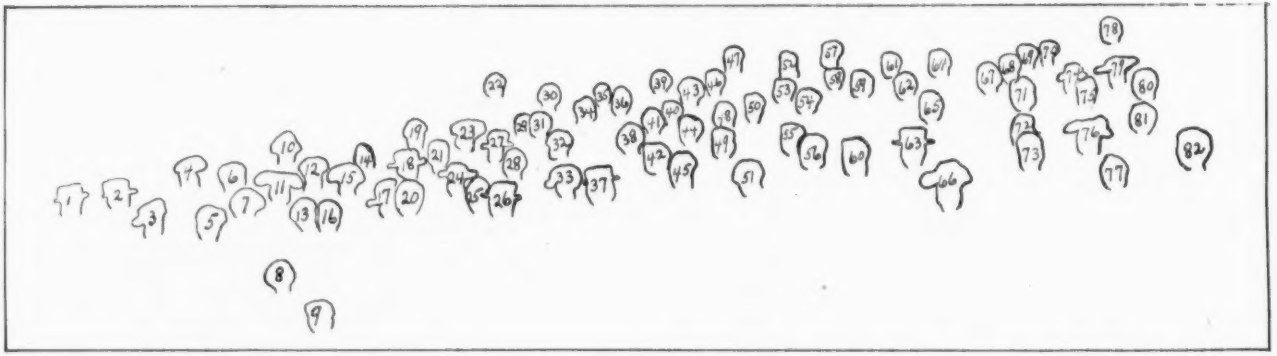


MEMBERS AND VISITORS AT THE TWENTY-FOURTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY, SEPTEMBER 1-4, 1920.

Courtesy of "POPULAR ASTRONOMY."

Courtesy of "POPULAR ASTRONOMY."

KEY TO PLATE.



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37. Tatlock
38. King
39. Barton
40. Stetson
41. Dugan
42. Peters
43. Russell
44. Derr
45. S. A. Mitchell
46. Silberstein
47. Stebbins
48. Lord
49. R. E Wilson
50. Ross
51. Miller
52. Green
53. Henroteau
54. J. F. Stone
55. Gallo
56. Townley
57. Bell
58. Olcott
59. Hammond
60. Jordan
61. Bailey
62. Littell
63. Roe
64. Alden
65. J. M. Poor
66. Mrs Roe
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68. Manson
69. Klotz
70. Mrs. Schlesinger
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72. Miss Lois Slocum
73. Slocum
74. Miss Gushee
75. Roy
76. Miss France
77. Miss Roy
78. Fox
79. Miss Hopkins
80. Warner
81. Miss Fuller
82. Mrs. Roy

THE JOURNAL

OF THE

ROYAL ASTRONOMICAL SOCIETY

OF CANADA

VOL. XIV NOVEMBER, 1920 No. 9

THE TWENTY-FOURTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

BY RALPH E. DE LURY.

The meeting of the American Astronomical Society at Smith College, Northampton, and Mount Holyoke College, South Hadley, on the first four days of September, attracted the largest attendance in the history of the society, seventy-two members and half as many visitors being present. A considerable number took advantage of the fine routes approaching Northampton in all directions to journey considerable distances by motor through the most wonderful stretches of beautiful hills and valleys, those being particularly fortunate who travelled along the Mohawk Trail with its glorious views from the hilltops and its shaded ways by the winding river, where in place of the smooth highway and the whirr of the hurrying cars, one's fancy pictured the old narrow trail in the mellow earth and the noiseless tread of mocassined feet. On the second day of the meeting a fine trolley ride was enjoyed to Mount Holyoke College, the route lying in most charming country, in which cultivated fields and untamed hills were in pleasing proportion, along the Connecticut valley between the Mount Tom and Mount Holyoke ranges and crossing the river after passing through Holyoke city, the return to Northampton in the late afternoon being made through the Holyoke Notch, Amherst and Old Hadley. Under the guidance of Professor of Geology,

W. J. Miller, several groups took the pleasant trip to view the tracks of the dinosaurs recorded in the sandstone along the river about six miles from Northampton, and later some went on to the top of Mount Tom.

Quarters were provided, for most of those attending, in the comfortable adjacent Smith College dormitories, Gillett and Northop Halls. A five minute walk led through the pleasant college grounds past the Observatory to Burton Hall in the large well-equipped lecture room of which the Northampton

Tracks of dinosaurs near Northampton, Mass., at the edge of the Connecticut River. The lowest print shows the depression of the ripple marks made in the damp sand by one of the eight-ton monsters, many million years ago. (Sketch from photo., taken by W. Henry.)

sessions were held. After a meeting of the Council at the Observatory on the preceding evening, the opening session was held on Wednesday morning, September 1; and another session for papers in the afternoon followed by tea on the lawn near the Observatory, after which the group photograph was taken with the Observatory in the background (Plate IX). In the evening at the Art Gallery there was a reception and inspection of the works of art. Next day the sessions were held in

Dwight Hall, Mount Holyoke College, and the party enjoyed the hospitality of the College at luncheon in Mary Brigham Hall, and at tea at the Observatory. In extending a hearty welcome to the visitors, the President, Miss Woolley, happily recalled Professor C. A. Young and his friendly relationship with the College. On Friday, after the meeting of the Council, sessions for papers were held, and in the evening a conversazione, with exhibits of photographs, charts, apparatus, etc. These exhibits and the intimate discussions are most interesting and valuable features of the meetings of the society. On Saturday morning the final meeting of the Council was held, followed by the final session for papers, reports and the election of officers.

The officers elected with those continuing in office are:

President, 1919-1922—Frank Schlesinger.

Vice-Presidents, 1919-1921—Walter S. Adams; 1920-1922, Otto Klotz.

Treasurer, 1920-1921—Benjamin Boss.

Secretary, 1918-1921—Joel Stebbins.

Councillors, 1919-1921—S. I. Bailey, W. J. Hussey; 1919-1922, H. N. Russell, V. M. Slipher; 1920-1923—Caroline E. Furness, John A. Miller.

In 1919 the Council of the Society nominated Messrs. H. N. Russell, W. W. Campbell and Joel Stebbins as representatives on the Division of Physical Sciences of the U. S. National Research Council then re-organized, and since then the two former were re-nominated to continue their terms for three-year periods, and henceforth one new representative yearly, will be similarly nominated to the Division. The U. S. National Committee of the International Astronomical Union consists of the three representatives of the American Astronomical Society named above, together with the President and Secretary of the Society, and since Secretary Stebbins is a member from both groups, by a provision made to cover such a case, the Society elected as fifth representative of the Committee, W. S. Eichelberger. W. W. Campbell is chairman and Joel Stebbins secretary of the Committee.

At each annual meeting the Society may elect one honorary member, and this year Sir Frank Watson Dyson, Astronomer Royal, Greenwich, was duly nominated and elected by the Council. Fifteen new members were elected.

By a vote of the Society the name "Committee on Variable Star Observations" was changed to "Committee on Variable Stars," and the committee was authorized to make an inventory of the idle telescopes which might be employed in furthering their work. Reports were read from the committees on asteriods, parallax, meteors and variable stars.

At the final session the following resolutions were introduced by Dr. Klotz, and adopted:

"Resolved, That the American Astronomical Society desires to express its appreciation to Smith College for its invitation to the Society for holding the annual meeting at the College; and also for the hospitality and the many kindnesses and courtesies extended to the members and guests.

"To Miss Bigelow, director of the observatory, and her staff more particularly thanks are due for the excellent arrangements that were made, so that our sojourn amongst the charming surroundings was one of continued delight."

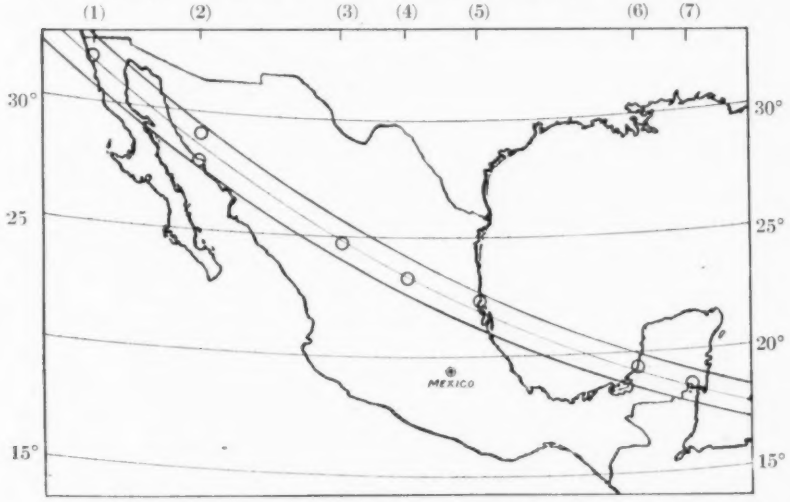
"Resolved, That the American Astronomical Society desires to record its appreciation to Mount Holyoke College and its President, Miss Mary E. Woolley, for the invitation to spend a day of the meeting of the Society at the College, and for the delightful entertainment offered.

"To Miss Anne S. Young, director of the observatory, and her staff, our thanks are due for their indefatigable efforts to make our visit so interesting and memorable."

The programme which Secretary Stebbins issued on August 24, contained the titles of 52 papers, 12 of which were placed on the supplementary list in cases where more than one paper was submitted by the same person. During the meeting 5 more titles were added to the list, making the fair total of 57 papers, most of which were presented. Abstracts by the authors will shortly appear in *Popular Astronomy* in the usual way so that a bare outline will only be given here. For convenience the papers are listed in groups as follows:

Sun and Solar System.—William F. Rigge, "When an eclipse prevented a war." Joaquin Gallo, "Preliminary work for the total eclipse of September 10, 1923," Director Gallo of

the National Observatory, Tacubaya, Mexico, gave an account of the meterological observations which have been made and which will be continued during the next two years at seven selected places (shown on the accompanying reduced tracing from the map) of which the 1st and 4th are considered the best sites for observing the eclipse, the former at Ensenada de Todos Santos being 8 m. above sea level, and the latter, Guadalaupe being 1500 m. in elevation. Margaret Harwood.



Suggested places in Mexico for observing the total solar eclipse of September 10, 1923. (Gallo). (1) Todos Santos, 14h. 26m. (2) Hermosillo and Guaymas, 14h 41m. (3) Cuencamé, 14h 59m. (4) Guadalupe, 15h 5m. ((5) Near Tampico, 15h 12m. (6) Champoton, 15h 24m. (7) Quintana Roo, Payo Obispo, 15h 27m. (Tracing from map supplied by Dr. Gallo.)

"The light-curve of Eros in 1914: A correction to the results previously published." Edward S. King, "Photometry of eclipsed moon." E. D. Roe, Jr., "Direct micrometrical observations of the sun. Exact formulas." George E. Hale and Ferdinand Ellerman, "The Mt. Wilson photographic map of the sun-spot spectrum." At the conversazione, Professor Fox ex-

plained the map which attracted much attention. The scale of the magnificent map is 1 cm. to 1 A, enlarged from the second order spectrum of the 75-foot spectrograph. The components of the Zeeman effect are shown on alternate strips of spectrum across the spot; and the extra lines in the umbra are very sharply portrayed. Through the kindness of Professor Hale a sample part of the map is reproduced in Plate X. Particular attention is called to the triplet, λ 5250.4, which shows on alternate strips the displacement of the p-component (the central line) of which phenomenon Director Hale spoke in his Annual Report of last year. Line λ5236.3 is an example of lines showing only slight magnetic effect. Philip Fox, "Motion of calcium flocculi about sun-spots." A. E. Douglas, "Map of Mars in 1920, and methods of producing it from drawings." Ralph E. De Lury and John L. O'Connor, "Notes on the solar rotation." Ralph E. De Lury and H. R. Kingston, "The constancy of solar wave-lengths and the possibility of determining the solar distance therefrom." Ralph E. De Lury, "A probable factor in the widening and increase in wave-lengths of the spectrum lines near the limb of the sun."

Binaries, Orbits and Variables. Antonia C. Maury, "The eclipsing binaries μ^1 Scorpii and V. Puppis." S. D. Townley, "Note on the variables RT Vulpeculæ and 9.1914." R. S. Dugan, "A photometric study of Y Camelopardalis." Annie J. Cannon, "Notes on changes in the spectrum of η Carinæ." J. S. Plaskett, "The spectroscopic orbits and absolute dimensions of the eclipsing variables TX Herculis and Y Cyngi." W. E. Harper, "The orbits of H. R. 6385, Boss 5900, and Boss 4622." Ralph E. Wilson and C. M. Huffer, "The orbits of ϵ Carinæ, Doradus and θ^1 Sagittarii." F. Henroteau and J. P. Henderson, "The spectroscopic binary ν Eridani"; and Nova Cygni." Photographs of the spectrum of the nova on successive nights (August 24-29) were shown along with the accompanying velocities which gradually increased to the (inferred) maximum, and the visual estimates of brightness. The spectra indicated no emission until during the night of the 25th. In

PLATE X

Part of the Mount Wilson map of the sun-spot spectrum reproduced to scale (1 cm to 1 A). Line 5250.4 shows great Zeeman displacements in alternate strips, as well as a slight displacement of the central component; while line 5236.3 shows very little magnetic effect. (From map supplied by Dr. Hale.)

the discussion, Professor Fox stated that he had seen H_α and H_β bright on the night of the 23rd. Slides of spectra taken at the Yerkes Observatory were also shown. F. Henroteau, "A region of the sky rich in variable stars." Reynold K. Young "The stationary calcium lines H and K in B-type stars"; and "The orbit of H. R. 8800." W. Carl Rufus, "The radial velocities of ten 0e5 stars." W. S. Adams and A. H. Joy, "The spectra of some variable stars"; and "Note on the spectrum of T Pyxidis." S. I. Bailey, "Periods of variable stars in the globular cluster, Messier 22." Harold L. Alden, "Observations of variable stars at the McCormick Observatory." Joel Stebbins, "Progress in photo-electric photometry, with a new light-curve of Algol." The new curve of variability of Algol measured with the photo-electric cell shows only slight divergences from that measured earlier with the selenium cell. E. S. King, "Velocity curves for spectroscopic binaries." Sets of curves were exhibited from which the elements of the observational curve could be readily inferred. Leon Campbell, "Notes on long-period variables."

Star Positions and Proper Motions.—Henry Norris Russell, "Radiation pressure and celestial motions"; and, "On the value of parallaxes derived from the proper motions of small groups of stars." S. A. Mitchell, "Systematic errors in stellar parallaxes determined by photography at the McCormick Observatory. H. L. Alden and S. A. Mitchell, "Parallax determinations of bright stars." Oliver J. Lee and George Van Biesbroeck, "Parallax results obtained at the Yerkes Observatory." Frank B. Littell, "Photographic zenith tube: Accuracy of observations for variation of latitude: Constant of aberration from four years' observation." The mean value for the four years was $20''.454$, corresponding to the parallax $8''.807$. Arthur J. Roy, "A solution of R minus D observations." Philip Fox, "Stellar parallax determinations at Dearborn Observatory."

Instruments and Mechanical Devices.—Alice H. Farnsworth, "The photometric fields of three Yerkes telescopes." Robert W. Willson, "A new method of observing the position of the centre of the sun." By using a cone of glass or multiple prism

arrangement the usual image of the sun is converted into an image with accurately defined centre on which settings may be made. Louis Bell, "Ghosts and oculars." The reflections and multiple reflections of many lenses and combinations of lenses were considered and the arrangements most free from them were pointed out. George E. Hale, "Some recent photographs taken with the 100-inch telescope." The lantern slides shown at the conversazione were greatly admired, and a congratulatory message was sent by the society to Dr. Hale and his staff. The sharpness of fine details in the moon pictures was perfect in the great enlargements. The photographs of nebulæ, star clusters, and Jupiter were splendid, and the comparisons with the 60-inch reflector illustrated the advantages of the larger. (Recent tests of the two reflectors—simultaneous 2-minute exposures on Seed 30 plates, average seeing, the same development—show limiting magnitudes of about 18 and 17—a gain of about a magnitude for the larger instrument). R. M. Stewart, "Temperature compensation of chronometers."

Miscellaneous.—Sebastian Albrecht, "Personality in the estimation of tenths." Frequent familiarization with known tenth settings and also the use of scale markings two-tenths wide lessen the preference for certain tenths which most individuals possess. F. Henroteau, "A curious effect of superposition of two photographic plates"; and, "A graphical construction for obtaining the period of a phenomenon." Frank E. Ross, "Mensurational properties of the photographic plate." Depending on the developer used, the parts of the film affected and unaffected by light, dry at different rates and produce shrinkages at the edges of images of such a nature that the measurements of the separations of adjacent star-images or spectrum lines may be seriously affected. George Henry Peters, "Absorption of the photographic rays by the atmospheric water content." E. C. Bower, "On telegraphing the position of a celestial object." Louis A. Bauer, "Concerning results of observed gravitational light deflections." L. Silberstein, "The astronomical aspects of aether theory versus relativity." The possibility of explaining the three Einstein

effects on the assumption of a condensation of the aether about the sun, was discussed. C. C. Kiess, "New lines in the spectrum of oxygen." R. M. Stewart, "Canadian transcontinental longitudes"; and, "Arlington time signals." H. T. Stetson, "The investigation of the plate errors in photographic photometry." H. N. Russell, "The probable diameters of the stars." Seven methods were discussed and comparisons made of results obtained by the various methods.

As usual, the meeting was most interesting. The annual meeting usually attracts members from even the greatest distances, and this year Townley came from California, Gallo from Mexico, and Douglas, with perrennial enthusiasm, from Arizona. There are no astronomical meetings in Canada just like it as our Society holds its meetings at the local centres. A large annual meeting might be arranged during the summer when the centres do not hold meetings, but the same purpose would be served if many more members of our Society would become members of the American Astronomical Society (which includes members from both American continents), and attend its meetings. The two Canadian observatories contributed fourteen papers to the meeting, and four members attended from the Dominion Observatory, whose Director, Dr. Klotz, was honoured by election to a Vice-Presidency. The next meeting of the Society will be held in connection with the large meeting of the American Association for the Advancement of Science to be held in Chicago in December, 1920. The place of the annual meeting next summer has not yet been decided upon.

THE CEPHEID VARIABLE R S ORIONIS

By F. Henroteau

The following observations were made by the author at the Observatoire Royal de Belgique in 1911. Their object was to determine the photographic light-curve of RS Orions and see how it compared with the visual. Not very many observations had been obtained; however, it was thoght advisable not to leave them unpublished any longer.

The photographic light-curve was determined by means of thirteen plates, using the focal method. The diameters of the star images were measured with a microscope, five times in a horizontal direction and five times in a vertical direction. The following stars were taken as comparison stars on each plate:

B.D. +14°. 1249.
B.D. +14°. 1248.
B.D. +14°. 1260.
B.D. +14°. 1262.

whose magnitudes given in the B.D. catalogue are respectively 8m. 5, 9m. 0, 8m. 4, and 9m. 1. In the different columns of the following table we designated:

1°. By the letter L or I the plates that have been used. L are the very rapid Lumiére plates (violet label) and I the Imperial plates (made in London).

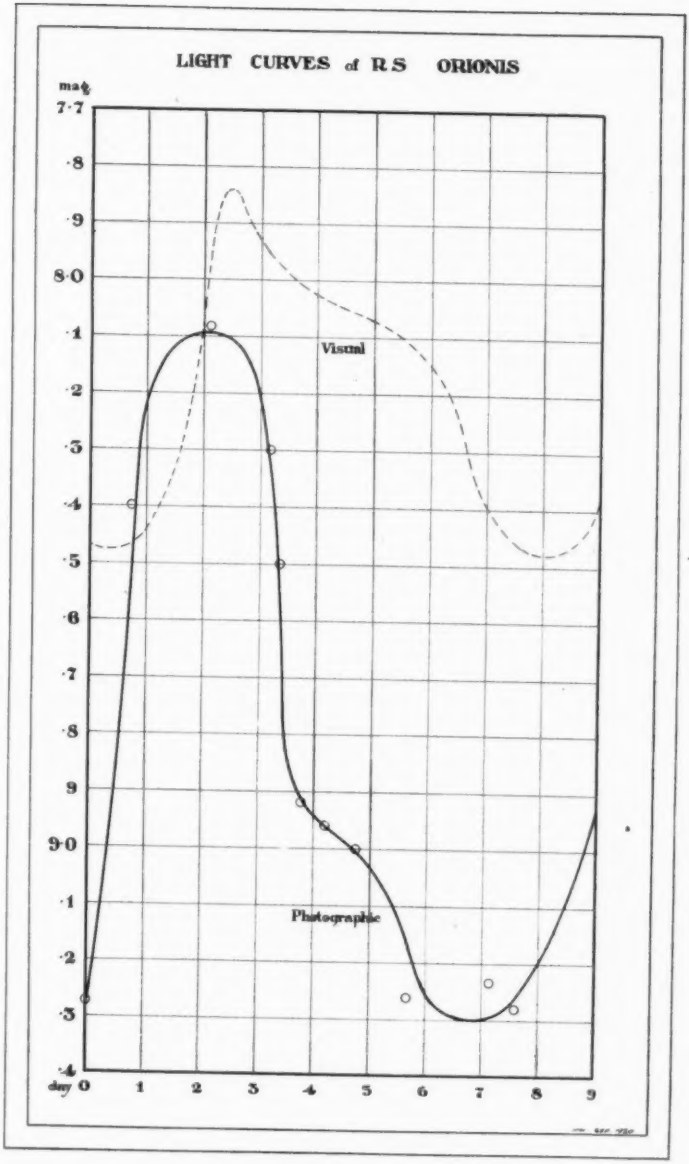
2°. To obtain the magnitudes from the measures we used the formula

$$m = a - n\sqrt{D}$$

Where a and n have been determined separately for each plate, using a least squares solution. The first comparison star was not used, however, since the results furnished by the measures of the diameters of its images showed that its photographic magnitude was very different from its visual. Nevertheless. it seems to confirm that the three other comparison stars have photographic magnitudes not very different from their visual.

Adopting the period given by Münch who determined the visual light-curve of RS Orions[1] we have the following table of observations:

[1] A. N. 182, 1909, p. 129.


LIGHT CURVES of R S ORIONIS
mag.
7·7
·8
·9
8·0
·1
·2
·3
·4
·5
·6
·7
·8
9
9·0
·1
·2
·3
·4
day 0
1
2
3
4
5
6
7
8
9
Visual
Photographic

OBSERVATIONS OF RS ORIONIS

Plate	Date 1911	G.M.T.	Phase	a	n	Lengths of exposure	Magnitude	Remarks
		h m	d			m		
L	Feb. 3	12 25	3.90	11.16	0.18	21	8.92	
L	" 3	13 34	3.95	16.32	0.54	21	9.26	Poor
L	" 13	8 55	6.20	14.02	0.48	12	9.83	Sky cloudy
L	" 15	8 51	0.64	10.57	0.12	21	8.40	
L	" 19	10 30	4.70	15.97	0.51	20	9.00	Interrupted by clouds
L	" 19	12 10	4.76	14.89	0.49	21	9.29	Poor
L	" 20	11 28	5.74	11.75	0.27	15	9.26	Interrupted by clouds
L	" 22	7 16	0.00	29.12	1.56	20	9.28	
L	" 24	10 31	2.14	14.09	0.43	20	8.08	
L	" 25	10 17	3.13	16.17	0.53	22	8.30	Clouds
I	" 25	11 54	3 19	17.12	0.73	20	8.50	
I	" 26	12 32	4.22	10.68	0.17	10	8.96	Immediately after clouds
I	Mar. 1	8 53	7.07	16.52	0.51	32	9.24	

From the above data we obtain the accompanying photographic light-curve compared to Münch's visual light curve (dotted lines). It is to be remarked that the amplitude of the photographic curve is much larger than that of the visual, both curves indicating a large deformation of the descending branch.

Dominion Observatory,
Ottawa.

ON A CURIOUS EFFECT OBTAINED BY SUPERPOSING TWO PHOTOGRAPHS OF STAR FIELDS, FROM WHICH AND ACCURATE METHOD OF MEASURING SMALL DISTANCES CAN BE DEVISED

By F. Henroteau

The two accompanying star field photographs have been obtained with a wide angle camera attached to the large equatorial telescope of the Dominion Observatory by Mr. Henderson and myself (exposures five hours). As is seen, they cover two different regions having however a large part in common; the first one has its center near the star 17 Vulpeculæ (20h 2m; +23° 19′) and the second one near the star 8 Cygni (19h 28m; +34° 14′). When we try to superpose the common regions we obtain a strange figure which seems to indicate a distribution in concentric circles or spirals. A slight shift of one photograph with respect to the other makes the common center of these spirals move a great amount; the center of the spirials for two different respective positions of the two plates is shown clearly on the accompanying plates representing two superpositions. The displacement of the spiral's center is nearly perpendicular to the direction of the shift of one plate with respect to the other, and is usually a great many times larger than this shift.

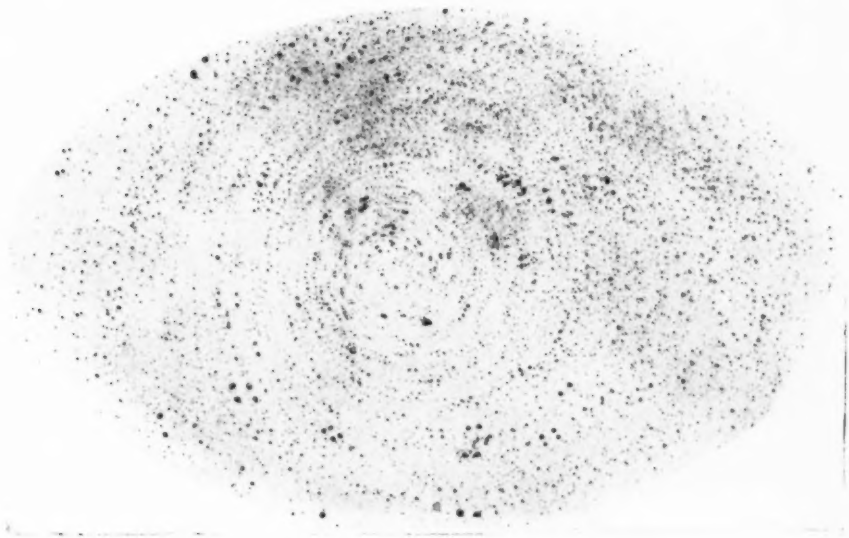
The explanation of such a distribution in seemingly concentric spirals is simple. The two photographs of the common field of stars are indeed projective representations, where the distance separating any two points of one representation very nearly equals the distance separating the two corresponding points of the other. To be concrete, let A and A^1 be two corresponding points on the two photographs, similarly for B and B^1. Let us put A over A^1, since A B is nearly equal to A^1B^1, B^1B will be nearly perpendicular to AB, irrespective where B is. It is easy to see then that all the BB's, for

(Error in cut: the upper letters should be A^2, B^2).

any point B will seem to be distributed in apparent circles or spirals with A as a center. If we now shift the second photograph in the direction B^1B and of the amount B^1B, so that B^1 falls on B, it is readily seen that the center of the apparent spirals will move from A to B.

We will have a much simpler case if instead of considering two different projective representations, we consider them identical, but the second one turned through a certain small angle ω with respect to the first. The apparent spirals will then become apparent concentric circles, and it is easy to prove that for a certain linear displacement a of one plane with respect to the other, the apparent displacement of the centre will be $b = a/2 \operatorname{cosec} \omega/2$. If ω is very small, b will be many times greater than a, easily 100 times, or even more, without however having much greater uncertainty in the determination of the position of the center of the apparent concentric circles. The displacement of b is nearly perpendicular to the displacement a, (forming an angle $\omega/2$ with this perpendicular direction).

Two plates constructed like this (identical projections) having each a well defined reference point or line, could then be used for measuring small displacements (letting them slide along a straight rule) and might by measuring the displacement of the center of the circles, replace with advantage the actual gauges or screw measuring engines. An apparatus based on the above principle would be simple, and easy to construct, and possibly much cheaper than devices now in use. It might assist greatly in measuring radial velocities, parallaxes . . . and other small quantities encountered in astronomy, physics or engineering. My thanks are due to Mr. Steadworthy, photographer at the Dominion Observatory, for his skilful treatment of the adjoining combined photographs.



SUPERPOSED PHOTOGRAPHS—FIRST POSITIONS

SUPERPOSED PHOTOGRAPHS—SECOND POSITIONS

W
N
Region of 17 Vulpeculæ
S
N
Region of χ Cygni
S
E

AN ASTRONOMICAL OBSERVATORY FOR UPPER CANADA

(From the Dominion Archives; supplied by Dr. O. Klotz)

Royal Engineers' Office,
Toronto, Upper Canada,
10th Novr., 1835.

For his Excellency,
M. General Sir John Colborne, K.C.B.,
Lt.-Governor of Upper Canada,
&c., &c., &c.

May is please Your Excellency:

Report on the Establishment of an Observatory in Upper Canada.

In obedience to Your Excellency's commands, I have the honour to state, that, having attentively considered the subject of establishing, in conformity to the views of The Lords Commissioners of the Admiralty, an Observatory for Astronomical purposes in Upper Canada; the points which suggest themselves, in relation to the essentials of situation and practicability, as well as permanent utility, have caused me to arrive at the following conclusions:

Advantages of Toronto as the site.

Toronto, the Capital of this Province, a city increasing in a ratio unprecedented in the New World, offers singular advantages desirable from its locality, in connection with Astronomy and those branches of the mixed and applied Sciences on which Astronomy depends.

Built on an immense basin of Lake Ontario, its littoral consists of a vast expanse of water, affording an unlimited horizon, whilst the country behind it rises so little as to obscure none of the Constellations visible in its latitude being in fact nothing more than a very gentle inclined plane from Lake Simcoe, or the height of land in the interior.

From it, as a centre, the Great Lakes and the countries between the Atlantic, Pacific and Arctic Oceans offer almost uninterrupted chains of water communication for those scientific enquiries relating to the figure of the earth and the development of the laws of magnetic influence, which can, in no other part of the world, be carried on over vast surfaces, with equal facility.

Latitude of Toronto. 49° 39′ 10″ N. L.

Almost equal distant from the three Great Oceans above mentioned, and itself the key of those immense Mediterraneans of fresh water, which constitute the importance of this rising Colony, it would be difficult to imagine a more eligible locality for a National observatory in the New World, in a favourable latitude being nearly that of 40°.

Its iso-magnetic line or meridian (if the term is allowable), is nearly connected with that of apparently *no variation*, which crosses Lake Ontario in its vicinity.

Perhaps owing to the western end of Lake Ontario being very deep water, much agitated, and receiving the rapid Niagara River thus never freezing opposite to Toronto.

Its climate is unusually mild, a continuance of excessive rigour, rarely occurring, whilst almost every other part of the country during winter, is visited with the usual severity of that season in Canada, thus ensuring without difficulty the continuance of Astronomic and Meteorological observations, whilst the known purity of the atmosphere would prevent injury to the more delicate parts of instruments.

On the point of having a university in addition to the college, Toronto would almost benefit most materially by being the spot selected for unfolding the resources of British Science, and if the Observatory was connected with the

In the American edition of the British Nautical Almanack, the want of a fixed observatory provided with the larger kind of Astronomical Instruments in North America is mentioned as the reason for omitting that portion of the Ephemeris relating to land observation, "*as there is no fixed observatory at present in this country,*" vide preface.

projected university, its effects upon the education of the people would amply repay any outlay which the Mother Country might think fit to expend upon it, and erect a monument of imperishable glory for that country. Impressed with the great importance of the Canadas as a link between Britain and the Old Worlds of Europe and Asia, and fully persuaded that the period is not far distant when the Pacific will open its commerce through these regions, and the mineral wealth as well as the agricultural resources of the countries divided by the Rocky Mountains from the Great Lakes and that ocean, will be unfolded, I know no steps more calculated to effect such a desirable era in colonization than that of fostering the germ of a great city on Lake Ontario, and none will tend more to this end than the establishment of an observatory for astronomical and geographical purposes at Toronto, under the protection and support of the Admiraly of England. It would be as superfluous to point out that there is no observatory of any note on the continent of America, as it would be useless to state the advantages to Science generally by the establishment of one here. These are considerations no doubt already well weighed and better understood than I can presume to offer opinions on.

Should the Lords Commissioners decide upon having admirable support to the extension of Science for the British dominions in the New World established at the Capital of Upper Canada, some consideration will be requisite, in choosing the site for it. For this purpose two or three positions present themselves.

1st One is on the Reserve in the new part of the

city where the proposed military establishment is to be erected, where the expanse of Lake Ontario is uninterrupted, never frozen in winter and seldom subject to land fog.

2nd The next is the proposed site for the University.

3rd The third is the Island in front of the city near Gibraltar point.

First The first is nearly unobjectionable, as nothing interferes with it except the occasional firing of heavy ordnance.

Second The second is also good, but as coal from Ohio is now coming into use as fuel and the whole mass of the city is near this site, the dense smoke will hereafter obscure the southern aspect.

Third The third is free from all objections; the space is clear and the site is sufficiently easy of access, without rendering it so much so as to cause visits from travellers, of mere idle curiosity, to be very frequent; a point in this cuntry worth consideration. The foundations of the buildings here would, however, require to be deep, as the Island is sandy.

I have the honour to be most respectfully,

Your Excellency's humble and obedient servant,

R. H. BONNYCASTLE,
Captain Royal Engineers,
Western District,
Upper Canada.

THE FESTIVAL OF THE DEAD

By R. G. Haliburton

(*Continued from page 343*)

with a moveable year, and this gives rise to even more uncertainty. Were the Isia connected with a fixed year, or with the moveable year? If with a fixed year, what was it?

Bunsen gives us no positive information on the subject. Greswell shows that the principle of the Julian year was always known in Egypt. Bunsen, referring to the probable existence of a civil and of a sacred or a sacerdotal year, says,[12] "there can be little reason to doubt that the Egyptians had a means of marking the progress of the cyclical year." After showing the absence of any data for calculations on the subject, he says that "it is probable, *though there is no proof of it as yet*, that the details of these" (their sacred festivals) "were reckoned by the primeval year, in which the 1st of Thoth commenced with the heliacal rising of Sirius. Biot even fancies he has discovered two proofs of it; but they will not satisfy anybody."

"*The best evidence on this head would be obtained, if we could get some more accurate knowledge of the great festival of Isis.* It has been already remarked that in the year 70 B.C. it took place a month after the autumnal equinox."

Speaking of the moveable festivals as affording data for calculations as to the nature of the year, he adds, "It was still easier to mark the commencement of the cyclical year, where, together with these festivals, there were others connected with immoveable points in the year, such as the solstices and equinox." "It was easy to calculate these points after nature had ceased to indicate the beginning of the year."

If my conjectures are correct, nature never ceased to afford a guide for the regulation of time to the Aztec or to the Egyptian. Let us take the Isia, as Bunsen suggests, as a test. The earliest date of their observance of which we have any record is B.C. 1350, when they were held on the 5th day of October,[13] and the latest is A.D. 355, when they took place about the 28th of October.[14]

Bunsen supplies us, as we have seen, with an approximation to the date of the Isia B.C. 70, by which it would appear that they must have been held then between the 21st and 24th of October. These dates extend over a period of 1705 years, and carry us back 3213 years from the present time. If the Isia, which were always attached to the 17th of Athyr, were held, as Plutarch says, "when the Pleiades are most distinct," and if Athyr was, as it has been designated, the month when these stars are most conspicuous, then these dates, though varying so much, should approximate to

[12] Egypt's Place, etc., iii. 51.
[13] Fasti Cath., iii. 160 and note; Fasti Cath. iv. 37.
[14] Fasti Cath., ii. 451, 453, 455 and note; also 503.

the time when the Pleiades culminated at midnight; and the assumption of many ancient and modern writers, that the Isia came, in the course of time, to be held at various seasons of the year, must be incorrect. It should be remembered that Eratosthenes only speaks from tradition when he says that the Isia were once held in spring; but both he and Geminus testify to the fact that, in their day, the Isia were celebrated ***in the autumn***;[15] and the same thing will be noticed as respects the alleged dates of the Isia given by other writers; they are generally connected with autumn.

The Pleiades must have culminated 3213 years ago, forty-five days earlier than they now do. The Festival of Durga, 1306 B.C., fell on the 1st of October, and the Isia, 1350 B.C., on the 5th, and Greswell considers the coincidence as very remarkable, and as proving that the Hindoos must have been guided by the Egyptians, who fifty years before had instituted the Isia, and invented all their myths relating to them. But 1350 B.C., the Australian savages must have held their Festival of the Pleiades about the 3d of October, and in that century the Mexicans must have regulated their cycle on the 3d of October, if the Aztec calendar was then in use. The same coincidence is found to exist between the other two dates and the midnight culmination of the Pleiades. In the first century B.C., the Isia, the Australian, the Mexican, and probably the Celtic festival of the year, or of the cycle of the Pleiades, must have been celebrated almost simultaneously on or about the 21st of October, and in the 4th century of our era, they must have been almost simultaneously celebrated on the 27th of October.

Hence we have a very remarkable procession in the Isia, in those instances almost exactly coinciding with the year of the Pleiades.

But it may be said that these are only coincidences. There are, however, some facts to show that they are not accidental. When the Isia were instituted at the beginning of October, the idea of seed-time became attached to them, and the Isia were described as occurring in seed-time in the calendar. But the Isia moved on in the course of time so palpably, that they were held after seed-time was nearly over.[16] This has already attracted attention, as showing a change in the date of the Isia, as well as proving the time of their institution. Couple with these facts what we have already seen, that Athyr and Taurus are synonymous; that classical writers describe Athyr as "the month ***when the Pleiades are most distinct,***" and I think it will be conceded that these are coincidences that at least deserve very careful inquiry.

[15] Egypt's Place in Universal History, iii. 37, 51.

[16] Fasti Cath., iii. 133; iv. 360. See, however, Sir Gardner Wilkinson's Manners and Customs of Ancient Egyptians, ii. ch. vi.

But the Celtic race appear to have had a cycle of thirty years, and the Mexicans one of fifty-two years regulated by Taurus or the Pleiades. Is it not a little remarkable that the Apis and Mnevis cycles were cycles of the *Bull*, and that at the end the Apis cycle, the *Bull* Apis was drowned in the Nile? It may yet be found that the Mexicans and the Egyptians had precisely the same simple mode of regulating their eras, by the midnight culmination of the stars in Taurus.

I now turn from the calendar of the Egyptians to that of the Hindoos, in which we can find unmistakable traces of the past existence and influence of the primeval year of Taurus. The worship of Durga is supposed to have, about the year B.C. 1306, been borrowed from the Egyptians, and to have been introduced into India with the astronomical theories of Egyptian science.

I give below two very remarkable passages from Greswell's works, which, in connection with this subject, are well worthy of a perusal.[17] His assumptions, however, are open to a good deal

[17] "The history of the calendar and of its various changes brings many proofs of this influence to light; and these discoveries are among the most important and the most interesting fruits of our researches. Who would believe, *a priori*, that the fable of Osiris and Isis should no sooner have been invented in Egypt, and associated with certain rites and observances there, than that the very same fable, attended with similar observances signalized and perpetuated by similar changes and corrections of the calendar also, critically accommodated to what had taken place in Egypt, in less than fifty years afterwards should be found, merely in a different dress and under a different name, in India, Phrygia, Cyprus, Arabia, Greece, and elsewhere? in quarters of the world greatly removed from Egypt, and between which and Egypt we should not have supposed that, at this early period of the history of each, there could have been any communication. The fact to which we allude, however, is certain; being attested by the evidence of the calendar itself.

"At present, as our subject requires, we must confine ourselves to the influence exercised by Egypt over its contemporaries in a much less objectionable way, *i.e.*, as the centre of knowledge and science; where all great and useful discoveries, all influential and permanent changes, in the principles or details of the reckoning of time, first took their rise; and from whence they were extended to the rest of the world."

"It has been already explained that the earliest correction of the primitive calendar among the Hindoos of antiquity was made A.M. 2699, B.C. 1306, æra cyc. 2701: and that the first idea of this correction must have been derived from the Egyptian (if correction that could be called), which took place in Egypt B.C. 1350, æra cyc. 2657, along with the introduction of the worship of Osiris and Isis; the proof of this connection between the Egyptian correction of earlier and the Hindoo one of later date being supplied by the fact that the Hindoo correction was attached to the 17th of the primitive Athyr, æra cyc. 2657; and that the Indian correction was associated from that time forward with the worship of Deunûs and Durga, as the Egyptian was with that of Osiris and Isis; and that the Indian Deunûs and Durga were absolutely the same kind of conceptions and impersonations in India as Osiris and Isis in Egypt." (Fasti Cath., iv. 31.)

of doubt. The rites of Isis and Osiris, and of the Hindoo Durga, are the same as those of the German Goddess of Death, of the Yucatan god *Mam* (the ancestor or grandfather), and of the Fiji god of Bulu, the world of spirits. All these deities, with Pluto, Ceres, and other funereal patrons of agriculture, sprang from the primeval festival of first fruits and of the dead—a festival which was subsequently converted into celebration in honor of a god, and yet still preserved through thousands of years its primitive and peculiar characteristics. Nor was the Hindoo calendar based on the astronomical science of the Egyptians; the arguments in favor of such a view would connect the calendar of the Australians, the Pacific Islanders, the Mexicans, and the Celts with that of the Egyptians.

This primeval calendar, with all its universal myths, was a heritage of all nations, and derived from the same common source to which the Egyptians owed their knowledge of the primitive year.

It appears that prior to B.C. 1306, the Hindoo festival of Durga, then attached as now to the autumnal equinox, and to the ninth day of the moon, had been regulated by some other system. From that time forth the new year's festival of Durga ceased to be regulated by the Pleiades, and became fixed by its relation to the tropical year.

Let us suppose that the year having been sidereal, and therefore progressive, the new year's festival became fixed. It is manifest that unless the original system of the calendar were also changed, the months would still move onward as before, and the first month in 2000 years would become the second month, and the last month would become the first. This is exactly what we find to be the case. In B.C. 1306, the months first obtained their names, but these names the Hindoos state had reference to contemporary astronomical phenomena. This Bentley assumes to have been the case. At that date, Cartica or Cartiguey, the month of the Pleiades, was the first month, and coincided then with our present October. Bailly, as we have seen, suggests that when that name was imposed, the year must have been in some way regulated by the rising or setting of the Pleiades in Cartica. I have already conjectured that Carticeya, the Hindoo god of war, was a mythical embodiment of the year of the Pleiades, and this I inferred solely from his name (which has apparently escaped observation hitherto) and from his emblems as they are given to us by Sir William Jones.[18]

But little question can exist that my conjecture is correct, as when it was made, the connection of Carticeya with the begin-

[18] See ante, p. 39.

ning of the Hindoo year and with the month of Cartica was unknown to me. "Mr. Bentley has mentioned several facts connected with this month, and under this name, from which we may infer that it must have received its name at this time, or have been supposed to have done so. He tells us that to render this designation of Kartika, as the first month, the more remarkable, and the more effectually to perpetuate the memory of it, they fabled the birth of Kartikeya, the Hindoo Mars, or God of War, in this month, whom he considers nevertheless only a personification of the year, as beginning in this month."[19]

"We may perceive a reason for connecting the birth of their Mars with the autumnal equinox, because that was the beginning of the military season in India." On this point I trust a very different solution, suggested by me, will not be considered less satisfactory than that which I have quoted. At the festival of Kartikeya at beginning of October, "it was usual to represent him riding on a peacock; which Mr. Bentley explains of his leading on the year, followed by the stars and planets in his train; and various epithets were familiarly applied to him, all founded on the same supposition of the relation of priority or precedence, in which he stood to the year, and to everything most closely connected with the year."

Hence, we find that B.C. 1306, when the Pleiades culminated at midnight at the beginning of October, the Hindoo year began with the month of the Pleiades; and that then, or soon after the festival of Carticeya, the god of the Pleiades was fixed at the beginning of Cartica, and was a new year's festival. Under these circumstances, after all that we have seen tending to this conclusion, it is difficult to avoid the inference, that as the Australians must have celebrated their festival of the Pleiades B.C. 1306, at the time that the Hindoos held their festival of the God of the Pleiades, *they were each using a primitive calendar, which must have been inherited from a common source by the Egyptians, the Hindoos, the Aztecs, and the Australians.*

But it is manifest that the Hindoo calendar still bears the evidence of its having been originally based on a sidereal and progressive year. In spite of the new year's festival becoming fixed to the autumnal equinox, the months have actually moved on in an equal ratio with the procession of the year of the Pleiades. Cartica, which began about the time of the culmination of the Pleiades at midnight, B.C. 1306, *i.e.*, at the beginning of October, now begins in the middle of November in the Carnatic calendar, and in other instances near the time of the acronycal rising of the

[19] Greswell's Fasti Cath., iv. 69, where Bentley's Astronomy, part i., sec. ii., p. 32, is cited.

Pleiades, about the 19th of October.[20] It has ceased to be the first, and has become the second month; and Aswina, the twelfth month of the year 3000 years ago, is now the first month.

Nor was this progressive character of the calendar unknown to the Hindoos, who, however, like the Egyptians, and most nations of antiquity, for some strange reason, involved the subject in myths probably often unintelligible to the initiated themselves.

Sir William Jones says, "Although M. de Gentil assures us that the modern Hindoos believe a complete revolution of the stars to be made in 24000 years, or 44 seconds of a degree to be passed in one year, yet we have reason to think that the old Indian astronomers had made a more accurate calculation, *but concealed their knowledge from the people under the veil of* 14 *Menwantaras,* 71 *divine ages,* compound cycles and years of different sorts, from these of Brahma, to those of Patala or the infernal regions."

Sir William Jones suggests[21] that many Hindoo myths will be found to be astronomical truths, veiled under a garb of mystery, and he cites the following myth as probably referring to their calendar:—

They believe that "in every 1000 divine ages, or in every day of Brahma, 14 Menus are successively invested with the sovereignty of the earth; each Menu, they suppose, transmits his empire to his sons and grandsons, during a period of 71 divine ages; and such a period they call a Manwantara."[22]

Let us apply the primitive year of the Pleiades to this enigma, and the solution is perfectly clear. *In every* 1000 *years* 14 *days are gained, and* 1 *day is gained in every* 71 *years.*

Hence it is plain that this must have referred to a sidereal year, which, it is equally evident, must have been the primitive year of the Pleiades.

The same conclusions to which we have been led by an analysis of the dates of the festival that marked the season of "the Pleiades above," will follow also, I believe, from a careful examination of the times of observance of the second festival. As far

[20] See Buchanan's India, i. 230; ii. 355; iii. 27.

[21] Sir William Jones' Works, iv. 6.

[22] See as to meaning of name, etc., Rodier's Antiquité des Races Humaines (Paris, 1862), p. 406.

It is evident that this era of 71 years was based on the erroneous assumption that a complete revolution of the stars, i.e., of the sidereal year around the tropical year would take place in 24,000 years. It would seem that after the invention of these myths, the Hindoos discovered that their menwantaras were too short, as they used 72 and 432 as the basis of their astronomical calculations. 432 x 60 or 72 x 360 gives us 25,920 years, which is not much in excess of the true period, 25,868 years, within which a complete revolution of the stars is effected.—See Sir Wm. Jones' Works, iv.

as I have had data to guide me, I have found that in remote antiquity, in several instances, the latter was held more than a month earlier than the date assigned to it at the beginning of our era; and that hence it must have shared in the progressive tendency of the primitive year.

I believe it will be found that the evidence of the lunar and sidereal mansions of the ancients tends also in the same direction, as they seem to evince this progressive character in relation to the seasons, and to the natural year. For instance, Cartica (the Pleiades) which was once the first, is now the third Hindoo mansion. But this is a matter which I must leave to astronomers, or at least must reserve any further remarks for a future occasion.

But it may be asked how is it that the memory of this natural measure of time supplied by the Pleiades, has been so long and so generally lost among nations north of the equator? The reason for this has been already supplied by the ancients themselves.

Everything connected with the year and its festivals was concealed by the Priests with the most watchful jealousy, and was veiled from the eyes of men in allegories and myths. Even when the mystic secret was partially disclosed to the initiated, it was guarded by the terrors of superstition and by the sanctity of oaths, which it was death to violate. The stories of the wandering Io, of Proserpine, Osiris, Menu, and the Phœnix, show this tendency to convert simple truths connected with astronomy or natural phenomena, into gods or fables. The memory of these secrets, so carefully guarded, must have gradually faded away; but the myths, in which they were concealed, must have outlived their own history and meaning, and must have long lingered after the key that could unlock their mystic treasures had been lost and forgotten.

That a primitive calendar must have existed among all ancient nations, will be apparent by comparing the data which I have collected, and the unquestionable fact of the actual existence of the year of the Pleiades among many existing races, with the following passage from Greswell's works. It has been written by an author, who, apparently, has not had the slightest suspicion that such a year as that of the Pleiades ever existed,[23] and who deriving all his conclusions purely from chronological and astronomical data, has used them in support of a theory utterly inconsistent with my own. Those peculiarities, which must necessarily have characterized all calendars based on the year of the Pleiades, have attracted his attention. Unable to account for them by any natural law, he has been driven to explain them partly by miracles,

[23] See ante, note to p. 27.

and partly by supposing that they had their source in the rapid diffusion of Egyptian science, a diffusion which must have been as marvellous as miracles themselves.

These coincidences and peculiarities in calendars which he describes, must have been very marked and very unquestionable, before he could have been driven to account for them by reasons, which he confesses are likely to be viewed as incredible by his readers. That not only his solution for these phenomena in the calendars of nations, but also his very facts themselves are imaginary, few will venture to state, who have studied his voluminous and learned works on the history of the calendar.[24] Unless his data, as well as his theories, are entirely fanciful, the primitive year which he describes, can be no other than that which is now in vogue in the southern hemisphere, and that gave its name to the month of November in the calendars of the Egyptians and the Hindoos. Let those who may question the truth of the statements in the extracts from Greswell which I give below,[25] first answer

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[24] It is a confirmation of the correctness of Greswell's view, as well as of my own, that *before having seen his works,* I had arrived at the same conclusion as he has, that there must have been a primitive calendar. What he has discovered by a study of astronomy and chronology, I was led to infer from finding a coincidence in the times when the festival of the dead is observed in different quarters of the globe. I was not then aware that the year beginning in February was substantially the same as that beginning in November, and like it regulated by the Pleiades, as will be apparent from the following passage from my first paper read before the Nova Scotian Institute, and published some months before I was able to procure from the Library of King's College the works of Greswell, from which I have so extensively quoted:—

"The uniformity of the time of the year when the festival was observed, affords strong grounds for assuming the existence of two primitive calendars during the stone age, probably one, if not both, of which, like the year of the Pleiades of the Pacific Islanders, divided the year into two equal parts; one of these having probably a southern origin, dividing the year in November and May, the other in February and August."

[25] "It has been demonstrated that, go where we may, visit and explore any part of the world we please, inquire into, investigate, and compare together the measures of time which men are using at this moment, or ever have used, trace them back to their utmost possible extent as we may, in Europe, in Asia, in Africa, in America, under all changes of circumstances, through all revolutions and confusions of the course of things in other respects, through all states and conditions of society, moral, religious and political, still, with respect to the measures of time, we must come to the same conclusion everywhere, viz., that the calendar is still, and always has been, the same; that this at least has never varied, whatsoever else may have done so; that this has continued identical with itself, or has never exhibited any other kind or degree of deviation from the standard of absolute identity, than what might be compared to the difference of dialects in a common language.

[91] *To be continued*

MEETINGS OF THE SOCIETY

AT TORONTO

May 18, 1920.—The Secretary read a communication from Mr. J. D. White, who had observed certain discs on either side of the sun as it rose on the morning of January 30th last. He inclosed a drawing of what he had seen, but no one could explain the phenomenon.

The paper for the evening was given by Mr. J. F. Heffron on "Some Problems in Lighthouse Illumination." By the proper marking of our waterways and coasts with effective beacons the risk of shipping has been diminished and the cost greatly reduced. At the present time we have 8,600 aids to navigation on our shores, of which number 380 are along the St. Lawrence from Montreal to the sea. The lighthouses as far as the Straits of Belle Isle are connected by means of telegraph. Voyages through Hudson's Strait to Hudson's Bay in the past were extremely dangerous, but now the coasts have been charted, and a system of lighthouses whose lights burn for eight months without attention, have been established, so that the trip is made in comparative safety.

The first system of lighthouses was established in Great Britain during the Middle Ages when wood and pitch were burnt on flat towers. In 1560 coal was used, which was replaced by oil about the middle of the last century. The oil vapour lamp was first installed on this continent in 1904. It possesses eight times the illuminating power of the ordinary oil lamp and consumes less oil. Electric lamps are too expensive for general use, but they are employed in harbours where the electricity can be obtained from the nearby town.

Ideal marking requires that every danger of approach be marked and that the arcs of lights overlap so that a mariner can see two lights at once. As all lights have a distinctive period of exposure and colour he is able to determine his position accurately.

The process of glass making, and in particular the huge lenses employed, was explained and illustrated by slides. Many interesting pictures of the various types of lighthouses and phases in the lighthouse keeper's life were shown. The keeper's pay is small, and the life very lonely, but the service attracts faithful men.

A discussion followed the lecture, during which the Rev. Mr. Fleming told of a stormy voyage he experienced through the Hudson's Strait in the late fall. He attributes the safety of their lives to the beacons described by the lecturer.

October 5.—The following were elected members of the Society:

Mr. J. W. Holland, Thessalon, Ont.
Mr. Henry Appleton, Bruce Mines, Ont.
Mr. Edward Evans, M.A., Hang Chow Christian College, Hang Chow, China
Mrs. S. P. Langdon, 163 Jamieson Avenue, Toronto.
Mr. John Ivey, 176 Evelyn Road, Toronto.
Mr. Abraham Hisey, 312 Kingswood Road, Toronto.
Mr. James C. Fleming, 489 Medicine Hat, Alta.
Mr. Anthony Taulbut, Box 797, Mission City, B.C.
Mr. Frederic Robert Surry, Kinsella, Alta.

The Librarian's Report showed that 228 periodicals were added to the

library during the summer. Of these 98 were from Canada, 72 from the United States, and 58 from various other countries.

The Librarian also reported the receipt of 92 volumes, quarto size, from the Paris Observatory, consisting of Bulletins, Memoires, and Observations. This donation is one of the handsomest ever received. The meeting in resolution expressed their hearty thanks and appreciation.

Rev. C. V. Pilcher, having recently returned from Australia, gave a very interesting account of his impressions of the southern skies.

A communication from Mr. McClung of Regina was read. The writer stated that he saw a sun-spot with the naked eye as the sun was observed through a smoky atmosphere.

A communication from Mr. C. R. Coutlee of Ottawa was read. Mr. Coutlee made a comparison between the different members of the solar system and various-sized vegetables and seeds.

Mr. A. F. Miller reported some recent observations he had made upon Mars, Nova Aquilæ No. 3, and Nova Cygni No. 3.

The President attended a Y.M.C.A. Camp at Fisher's Glen, Lake Erie, during the summer and gave a course of lectures on Astronomy to the boys. Professor Chant gave a similar series of lectures at the Boys' Leaders' camp in Algonquin Park.

October 19.—Rev. J. K. MacDonald, Spruce Street, Galt, was elected a member of the Society.

A number of observations on sun-spots, the aurora, and magnetic disturbances were reported by various members.

Mr. A. F. Hunter referred to the following observations he made at Barrie, Ont., on September 20th at 5.50 a.m. While the sun had not yet risen he observed an image of the sun projected against a cloud. He regarded the phenomenon as being similar to the image formed by a camera, *i.e.*, the sun's rays were shining through a hole in a distant cloud. He estimated the size of the image as half a degree, and the distance of the image as 4 to 5 miles, from which he deduced the fact that the aperture would have to be about 25 miles away, this indeed was a large camera. Mr. A. F. Miller attributed this phenomenlon to a reflection of the sun's rays similar to a mirage. Early in the morning there are layers of different densities in the atosphere which act like plates of glasss. causing the reflection of the sun's rays. Mr. A. F. Hunter referred to a similar observation made some years ago by the late Arthur Harvey; while on Lake Erie he saw the sun set, and a little while later it appeared again and at the time he explained the effect by the camera theory.

Mr. A. R. Hassard presented some drawings he had made of the sun-spots for the past 11 days.

Mr. A. F. Miller gave the paper of the evening on "A Model of a Star Spectroscope." The lecturer displayed a spectroscope of his own design and construction, and explained in detail each part of the instrument. While the spectroscope is not adapted for photographic work the amateur may make interesting and useful observations by comparing the spectrum of a star directly with the spectrum of an element.

J. A. PEARCE,
Recorder.

NOTES FROM THE METEOROLOGICAL SERVICE

Summary Report of the Weather for August and September, 1920.

Temperature—In August the mean temperature was normal or slightly below over the northern districts of British Columbia and Alberta and in a few sections near Lake Huron in Ontario, while in other parts of the Dominion it was above, the positive departures ranging from three to five degrees in Southern Alberta and Manitoba and from three to four degrees in Eastern Ontario, Western Quebec and some localities in the Maritime Provinces.

In September the temperature was above the average from Alberta to Central Quebec, diminishing to average or slightly below towards the Pacific and Atlantic Coasts. Over the greater portion of Ontario the positive departure was from 3 to 5 degrees and in Southern Alberta and locally in Manitoba as much as 4 degrees.

Precipitation—In August the rainfall was above the normal in British Columbia, Northern Saskatchewan, the greater part of Quebec and the Maritime Provinces, and in a few localities in Ontario; elsewhere it was below the average. In many places in Ontario the total fall was less than two inches and in Southern Alberta less than one inch.

In September the precipitation in British Columbia was much above the average nearly everywhere. In the Lower Mainland it was unusually heavy, Vancouver recording an excess of 6.90 inches. In Alberta it was slightly below in the Northern portion and much below in the Southern portion where in some places no precipitation occurred. In Saskatchewan except in the extreme Southwestern portion it was above, Qu'Appelle exceeding the average by one inch. In Manitoba it was exceeded by from about three-quarters of an inch to an inch and a half. In Ontario from Kingston to the Eastern boundary and north to Ottawa and its vicinity there was from 1.40 to 2.00 inches more than the average while over most of the remainder of the Province there was a

deficiency of from about one to two inches. Quebec was a little above the average in some parts of the Province and below in others, Father Point recorded 1.45 inches less than the usual amount. In the Maritime Provinces the rainfall was very much above the average in some localities and considerably below in others. Chatham recorded a positive departure of 3.76 inches, while on the other hand Halifax had a negative departure of 2.31 inches.

Magnetic Disturbances.
August, 1920.

During the month of August, 1920, the magnetic records at both Agincourt and Meanook Observatories indicate continued inactivity of the Magnetic Forces. Very moderate disturbances were recorded on the 12th, 22nd, and 30th. The range in the different elements is given in the subjoined table.

	Agincourt			Meanook
Date	H	Z	D	D
	γ	γ	′	′
August 12th	309	302	48.1	41.0
" 22nd	159	173	58.2	94.7
" 30th	91	56	20.5	86.0

There were very few sunspots to be seen during the month and those present were very small.

The Aurora was most widely distributed on the 7th, 21st, and 22nd, but on many of the remaining days was not reported at all.

TEMPERATURES FOR AUGUST AND SEPTEMBER.

STATIONS	AUGUST		STATIONS	SEPTEMBER	
	Highest	Lowest		Highest	Lowest
Yukon			*Yukon*		
Dawson	82	28	Dawson	64	16
British Columbia			*British Columbia*		
Atlin	69	30	Atlin	62	28
Agassiz	92	43	Barkerville	65	29
Barkerville	76	30	Kamloops	83	38
Kamloops	97	43	New Westminster	81	44
New Westminster	85	46	Prince Rupert	72	38
Vancouver	85	45	Vancouver	74	44
Victoria	84	46	Victoria	74	46
Western Provinces			*Western Provinces*		
Battleford	91	35	Battleford	80	30
Calgary	92	31	Calgary	86	28
Edmonton	85	34	Edmonton	90	24
Medicine Hat	95	45	Medicine Hat	86	.29
Minnedosa	96	28	Minnedosa	78	29
Moosejaw	100	33	Moosejaw	88	24
Oakbank	94	32	Oakbank	85	35
Portage la Prairie	92	40	Portage la Prairie	80	33
Prince Albert	93	40	Prince Albert	81	28
Qu'Appelle	96	30	Qu'Appelle	86	23
Regina	100	30	Regina	87	22
Saskatoon	95	35	Saskatoon	82	32
Souris	97	34	Souris	86	33
Swift Current	102	38	Swift Current	90	26
Winnipeg	94	42	Winnipeg	84	32
Ontario			*Ontario*		
Oak Ridges	87	44	Oak Ridges	87	32
Bancroft	90	37	Bancroft	88	20
Barrie	85	43	Barrie	83	32
Beatrice	85	35	Beatrice	84	25
Bloomfield	86	46	Bloomfield	83	35
Chatham	91	47	Chatham	94	42
Clinton	87	39	Clinton	85	36
Collingwood	86	45	Collingwood	95	50
Cottam	87	49	Cottam	90	40
Georgetown	85	45	Georgetown	84	33
Gravenhurst	90	40	Gravenhurst	87	33
Grimsby	86	45	Grimsby	87	42
Guelph	89	42	Guelph	86	32
Haliburton	92	33	Haliburton	90	25
Huntsville	87	36	Huntsville	89	28
Kenora	88	41	Kenora	80	31
Kitchener	90	41	Kitchener	86	32
Kingston	83	51	Kingston	81	38
London	91	42	London	84	37
Lucknow	86	36	Lucknow	89	29
North Gower	95	38	North Gower	88	27
Oshawa	85	42	Oshawa	85	47
Ottawa	93	48	Ottawa	91	32
Paris	92	46	Paris	91	36
Parry Sound	87	42	Parry Sound	87	31
Peterborough	88	43	Peterborough	90	31
Port Arthur	86	38	Port Arthur	81	28
Port Burwell	80	44	Port Burwell	80	39
Port Dover	88	46	Port Dover	82	38
Port Stanley	82	45	Port Stanley	79	38
Queensborough	87	43	Queensborough	84	29
Ronville	85	38	Ronville	82	30
Southampton	84	39	Southampton	85	32
Stonecliffe	81	37	Stonecliffe	90	16
Stoney Creek	88	48	Stoney Creek	87	38
Toronto	89	48	Toronto	87	37
Uxbridge	87	37	Uxbridge	84	31
Wallaceburg	91	46	Wallaceburg	83	42
Welland	87	44	Welland	85	39
White River	84	25	White River	81	16
Quebec			*Quebec*		
Brome	85	37	Brome	82	25
Father Point	74	36	Father Point	72	34
Montreal	90	49	Montreal	83	37
Quebec	86	45	Quebec	78	34
Sherbrooke	90	43	Sherbrooke	81	29
Maritime Provinces			*Maritime Provinces*		
Charlottetown	88	46	Charlottetown	80	40
Chatham	94	46	Chatham	86	34
Fredericton	94	32	Fredericton	87	30
Halifax	86	44	Halifax	81	36
Moncton	90	45	St. John	79	38
St. John	79	50	Sussex	82	29
Sussex	88	39	Sydney	82	38
Sydney	90	48	Yarmouth	82	36
Yarmouth	78	46			

EARTHQUAKE RECORDS BY MILNE SEISMOGRAPH, TORONTO

P.T. = Preliminary Tremors. S. = Secondary Waves. L. = Large Waves. A. C. = Air Currents
Time is Greenwich Mean Civil Time; given in hours, minutes and decimals of minutes; 0 or 24 h = midnight.

SIR FREDERIC STUPART, F.R.S.C., DIRECTOR

No.	Date 1920	P. T. Comm.	S. Comm.	L. W. Comm.	Max.	End	Max Amp.	Remarks
		h m	h m	h m	h m	h m	mm	
2174	Aug. 3			3 20?8			0.2	Micros going on
2175	" 3	20 06?6)	20 19.2	20 33.3)	20 47.5	Micros	1.4	Preceded by minute micros
		20 11.4)		20 42.5)				
2176	" 11			20 13.4	20 15.6	Micros	0.8	
2177	" 12			6 39.5	6 42.1	6 45.9	0.2	Gradual thickening
2178	" 13			2 22.0	2 23.3	2 32.5	0.2	
2179	" 15		8 46.9		8 49.7	10 45.5	0.7	
2180	" 20			17 02.4	17 10.3	17 38.8	0.7	Light turned down at 16:38 to change paper
2181	" 26			22 53.8		22 56.8	0.2	May not be seismic
2182	" 26	23 09.1	23 17.4	23 32.8	23 39.8	1 21.2	0.8	
2183	" 29			11 53.8	11 57.3	12 01.2	0.2	
2184	Sept. 1			3?04.0			0.1	Doubtful as to being seismic
2185	" 4	15 12.9	15 19.7	15 27.5	15 29.5	16 00.7	0.3	
2186	" 7			6 31.3	6 33.4	6 41.1	0.2	
2187	" 8		2 12.1	2 14.9	2?15.9)	4?09.8	0?5)	Faint trace
					2 57.8)		0.8)	Italian quake
2188	" 9	19?15.2	19 25.1	19 54.9)	20 16.6	21 32.6	0.5	Preceded by minute micros
				19 58.8)				
2189	" 18			0 07.7	0 11.8	0 18.0	0.8	Difficult seismogram to interpret
2190	" 20	14 57.7	15 08.5	15 15.3)	15?49.8	18 32.6	23.0	Trace rather faint
				15 40.3)				
2191	" 21			3 38.9	3 46.4	3 51.2	0.3	Micros 3 h. 23.3 m. to 3 h. 25.1 m.
2192	" 24		22 08.7	22 12.4	22 17.4	23 06.4	2.0	P not recorded
2193	" 24			23 46.6		23 49.9	0.2	
2194	" 27			5?30.9)	5 45.5	6 30.9	0.9	
				5 42.1)				

Period of Boom 18 seconds. Pillar inclination 1 mm = 0".45

EARTHQUAKE RECORDS BY MILNE SEISMOGRAPH, VICTORIA, B.C.

F. NAPIER DENISON, SUPERINTENDENT

No.	Date 1920	P. T. Comm.	S. Comm.	L. W. Comm.	Max.	End	Max Amp.	Remarks
		h m s	h m s	h m s	h m s	h m s	mm	
2172	Aug. 3	3?18 42	3?26 34	3?41 19	3?53 05	4 30 30	0.1	6300?km.
2173	" 3	20 20 42	20 26 07	20 34 28	20 41 21	22 44 18	1.5	3620 km. Time marks indistinct. Prob. Aleutian Is.
2174	" 11	20 38 51		20 41 45	20 44 42	20 51 35	0.2	
2175	" 12	6?51 35			6 58 28	7 09 48	0.2	
2176	" 15	8 28 05		8 38 54	8 45 47	10 57 36	0.6	
2177	" 17				3 17 14		0 05	
2178	" 20	16 39 08	16 47 30	16 58 19	17 06 41	18 58 48	0.6	6860 km.
2179	" 25				22 44 39		0.2	
2180	" 26	23 01 09	23 06 04	23 10 30	23 15 25	0 08 32	1.0	3170 km.
2181	Sept. 1	3 03 13			3 08 37	3 17 28	0 2	Aug. 29th a.m. Quake at Malta.
2182	" 4	14 58 02			15 32 58	16 22 38	0 2	Aug. 30th, 8.59 p.m. Quake at Hot Springs, S. Dakota
2183	" 7	6 28 14		6 35 07	6 39 48	6 49 22	0.3	
2184	" 8		1?58 47	2 08 38)	2 17 58	3 16 00	0.5	
				2 15 09)				
2185	" 9	19 09 11	19 19 01	19 31 48	19 37 13	21 42 08	0.5	8570 km.
2186	" 18				0 27 09		0.2	
2187	" 20	14 51 26	14 55 22	15 02 16	15 23 54)	18 44 33	5.5	2390 km. Alaska
					15 31 07)			
2188	" 24			5 49 46	5 53 42		0.1	
2189	" 24	22 12 29		22 22 19	22 29 32	22 46 24	0 5	
2190	" 27	5?35 16		5 37 43	5 41 10	5 50 30	0.5	1400 km. Real P may not be recorded. Prob. Alaska

Peroid of Boom 18 seconds. Pillar inclination 1 mm = 0".54

BOOK REVIEWS

Essai d'Astronométéorologie et ses Applications a la Prévision du Temps, par A. Nodon, 195 pages, $5\frac{1}{2} \times 9$ inches. Paris, Gauthiers-Villars, 1920.

The underlying causes of the changes in the weather are so numerous and so interconnected that the task of sorting them out and assigning the effect due to each is extremely difficult. In this book the author, who has wide scientific attainments, attempts to trace the effects produced by the sun, the moon and the planets. By a detailed study of the nature of the weather during certain months and the record of sun-spots, faculae, and other astronomical conditions for the same period he is led to deduce a definite relation between them.

As an example, consider the month of January, 1911. On plotting in curves the number of sun-spots and faculae, the temperature, the rain and the atmospheric pressure, the electrical potential of the air, the phases of the moon, the zodiacal light and some other cosmic phenomena, he finds that the great atmospheric disturbances observed in this month were manifested during the rapid disappearance of solar foci and the formation of other foci as well as during periods of agitation of facular centres over the central meridian. Also, the dates of full and new moon accord with those of great agitation of the atmosphere. In addition, at these times there were electric disturbances, earthquakes, general depression of the atmosphere, and rain. Between two successive periods of general disturbance there were periods of fine weather.

The distribution of storms throughout the year, and other atmospheric effects are discussed, and the author gives certain directions to be followed in predicting the weather. Just how valid his deductions are it is hard to say, but it is to be hoped that in the near future the astronomer will be able to assist the meteorologist to improve his forecasts and to permit him to make them for longer periods in advance. This book will help towards that end.

Les Étoiles Simples par F. Henroteau, 244 pages, $4\frac{1}{2} \times 6\frac{3}{4}$ in., Paris: Librairie Octave Dion, 1921.

For a number of years the great Encyclopédie Scientifique has been in the course of publication in France. It is to contain about 1,000 volumes, of which some 29 will relate to Astronomy and Celestial Physics. Six in this division have already appeared, the above work being the latest, as indeed one should expect from the date on the title page.

The author is a Doctor of Sciences of the University of Brussels and is now on the staff of the Dominion Observatory at Ottawa.

The titles of the 12 chapters are: stellar magnitudes, constellations; classification of the stars, catalogues and maps; spectral classes and evolution of the stars; photometry; colours; parallaxes; proper motions; radial velocities; proper motion of the sun; enumeration and distribution of the stars; temperatures of the stars; twinkling of the stars.

Each subject is treated in a comprehensive but concise manner, and one cannot read the book without obtaining a clear view of the entire subject. The language is simple and straightforward, and is easily understood by an English-speaking reader. The only criticism which the present writer would offer is that the paper is inferior, not on a par with the quality of the contents.

C. A. CHANT

NOTES AND QUERIES

Communications are Invited, Especially from Amateurs. The Editor will try to Secure Answers to Queries

The Coming Disappearance of Saturn's Rings.

In the *Annuaire* of the Royal Observatory of Belgium Dr. P. Stroobant, assistant director, gives an extended and interesting account of observations of the ring of Saturn from its discovery by Galileo in 1610 to the coming disappearance in 1920-21.

As the planet revolves about the sun we on the earth at some times see the north face of the rings, at others, the south face; also, at some times the sun illuminates the north face, at others the south face. Now, considering the rings to form a flat opaque body, it is evident that only one face can be illuminated at a time and for the rings to be visible to us we must be in a position to see that face. In other words, the earth and the sun must both be on the north side or both on the south side of the rings or they can not be seen. If one is on one side and the other on the other the rings will be invisible.

From the ephemeris of Saturn in the *Almanac* it is found that the sun's rays illuminate the south face of the rings until April 10th, 1921, on which date the sun is in the plane of the rings, and after that the north face is in the sunshine. Also, we on the earth see the south face of the rings until November 7th, 1920, and the north face until February 22nd, 1921. Then the south face is seen by us until August 3rd, 1921, and after that we see the north face. Dr. Stroobant finds that on November 7th, the rings will disappear and will remain invisible until February 22nd, 1921, during this period the sun being on the south side and the earth on the north side of the rings; and that the rings will disappear again on April 10th and will remain invisible until August 3rd. During this period the sun will be on the north side and the earth on the south side of the rings. After August 3rd both bodies will be on the north side and the rings will remain visible for half a revolution of Saturn, or for nearly 15 years.

To the following matters observers are asked to direct their attention:

1. Comparison of the brightness of the rings with that of different parts of the disc of the planet, notably the equatorial belt.

2. The luminosity of the rings at different distances from the globe, of the preceding, or western side, compared to the luminosity of the corresponding points of the following, or eastern, side.

3. Evaluation, by comparison with the thickness of the illuminated wires of the eyepice, or by measurement if that is possible, of the thickness of the rings on the two sides of the planet.

4. The existence, aspect and position of the luminous condensations and of the bright points at the east and the west of the globe.

5. Research of the nebulosities or luminous appendages enveloping the rings.

6. Comparison of the breadth of the anterior part and the posterior part of the rings at the epoch when the sun is in the neighbourhood of their mean plane.

7. The aspect of the shadow of the rings and of the projection of them upon the globe: the form, the intensity, the breadth (compared to that of the dark wires or measured by the micrometer), the possible division of this shadow into zones of different intensity.

8. The visibility of Cassini's division and of the dark ring at the epoch when the elevation of the earth above the plane of the rings is sufficient to give to it an appreciable width.

9. The determination of the angle of position of the rings.

10. Observation of the belts and of the spots on the surface of the disc, and measurement of its flattening.

11. Estimation of the brightness of the satellites and determination of their relative positions.

OBSERVATORY CLUB.

The programme in continuation of the past three years, of the Observatory Club addresses so far arranged for the winter, being by the technical members of the staff of the Dominion Observatory, Ottawa, is as follows:

R. M. STEWART, Adjustment of Longitudes and the Canadian Longitude Net.
RALPH E. DELURY, The modifications of the wave-lengths of Solar spectrum lines due to various causes.
J. L. O'CONNOR, Sun-spots.
E. A. HODGSON, The Propagation of Earthquake Waves.
C. C. SMITH, Graduation errors of the Meridian Circle.
W. A. DIER, The audion bulb in wireless reception.
R. J. MCDIARMID, Discussion of the 1912 and 1913 Meridian Circle Transit Observations.
W. S. MCCLENAHAN, Variation in Polar Deviation at upper and lower culminations.
J. P. HENDERSON, Electricity as minutely divided.

F. HENROTEAU, The interstellar clouds of metallic gases.
W. W. DOXSEE, Tape testing at Surveys Laboratory.
A. H. SWINBURN, The field work of Latitude and Longitude observations.
C. A. FRENCH, Mganetic Secular Variation in Canada during 1907-1920.
B. R. HOOPER, The reduction of magnetic observations to epoch.
A. H. MILLER, The determination of the compressibility of water.
E. C. ARBOGAST, The reduction of declination observations with the meridian circle. O. K.

NEW SWEDISH ASTRONOMICAL JOURNAL

Recently the publication by the Swedish Astronomical Society of a journal entitled *Populär Astronomisk Tidskrift* was begun. It is conducted by Svante Arrhenius, Karl Bohlin, N. V. E. Nordenmark and H. von Zeipel, with headquarters in Stockholm. The first number contains articles by H. von Zeipel, V. Carlheim-Gyllensköld, Nils Tamm, and K. Bohlin, as well as astronomical news. The price is Kr. 15 per year, and our Canadian Society wishes it abundant success.

HELPS TO REMEMBER SIZES AND DISTANCES OF THE PLANETS.

(BY C. R. COUTLEE, Ottawa).

Place a *pumpkin* for the sun, 12 paces away an *onion seed* for Mercury, 10 paces further a *grain of wheat* for Venus; 8 paces further, a similar *grain* for the earth; 16 paces on, a small *grain of wheat* for Mars; 110 paces on, a *potato* for Jupiter; 129 paces on, a *smaller potato* for Saturn; 288 paces further, a *cherry* for Uranus; and 324 paces further still, a *cherry* for Neptune. The initials of the last three planets spell *sun*.

Considering a terrestrial school globe 2 feet in diameter the sun would be a globe 216 feet across and $4\frac{1}{2}$ miles distant. It would occupy one acre, or about eight city lots. The moon would be half a foot across and 60 feet from the terrestrial globe.

By the rotation of the earth objects at the equator travel with the speed of a bullet—1,500 feet per second, and it moves about the sun at 18 miles per second, at which rate it could reach the moon in $3\frac{1}{2}$ hours.

The angular diameter of the moon is about half a degree. Two strings each 100 feet long branching from a point and held $1\frac{3}{4}$ inches apart at the free ends would enclose one degree. If both strings were produced to the moon their ends would be almost 4,200 miles apart, which is approximately double the moon's diameter.

"THE SUN DRAWING WATER"

In the last two numbers of the JOURNAL appear some notes on the above subject, as well as a suggestion as to its cause. This was given without much assurance of its correctness and further consideration has led me to change my views.

I believe the phenomenon is to be explained in the same way as a meteor radiant. The light comes from the sun in parallel rays and passes through openings in or between the clouds. The portions coming through the openings will be in parallel shafts, whose paths will be shown by any vapour or dust which may be in the air between the observer and the clouds or which may envelop the observer. In this way a set of bright shafts or streamers will be produced, such as are seen when sunlight streams through holes in the wall of a building and its course is shown by dust in the air within.

The streamers come towards the observer. Those passing above his head will appear to run upwards vertically from the sun. Those passing to the right will appear to run out from the sun to the right; and so on for the rest. They actually travel in parallel paths, with the observer in the midst of them, but to him they appear to radiate from the sun. An observer in Alberta writes questioning my previous suggestion and stating that sometimes the streamers may be seen to converge to a point in the sky opposite to the sun. A few days after receiving his letter at about 5.15 p.m. an assistant drew my attention to a shaft of light in the east. On closer observation we saw several shafts, apparently diverging from a point in the sky just below the horizon and opposite to the sun. This confirms the explanation given above. C. A. C.

The Royal Astronomical Society of Canada

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